Paper No. 11

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte Chris W. Baumgart and Christopher A. Ciarcia

Appeal No. 95-1217
Application 08/039,674[1]

Before HAIRSTON, BARRETT, and FLEMING, *Administrative Patent Judges*.

FLEMING, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1 through 13 and claims 15 through 20, all of the claims pending in this application. Claim 14 has been canceled.

The invention is directed to an automatic target recognition apparatus and method. The invention can be used

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[1] Application for patent filed March 30, 1993.

to recognize an object, such as a land mine, within a digitized image. In the

claimed invention, a camera/digitizer transmits a digitized image signal to a computer. The computer processes the image by using a number of different analysis chains. Examples of analysis techniques that may be used in these analysis chains are object texture analysis, background subtraction, and object edge enhancement. The analysis chains are shown in Figure 3. Each of the analysis chains receives the image signal and analyzes it in parallel with the other analysis chains. The information obtained in each of the analysis chains can be combined to obtain a single result.

Independent claim 1 is reproduced as follows:

1. An automatic target recognition apparatus for recognizing an object within a digitized image, comprising:

a video camera and digitizer for producing a digitized image;

and a computer for processing the digitized image, wherein;

the image is processed in a plurality of parallel analysis chains, each of said analysis chains being a distinct means for analyzing the image such that the object may be identified by one or more of said parallel analysis chains.

The Examiner relied on the following references:

Corwin et al.	5,233,541	8/93
Fukumizu	5,060,278	10/91
Crimmins et al.	4,644,585	2/87
Prakash	5,054,101	10/91
Huynh et al.	4,878,114	10/89
Eckstein, Jr.	3,947,833	3/76
Natakani	4,817,174	3/89
Hunt et al.	4,335,427	6/82

Claims 1 through 13 and claims 15 through 20 stand rejected under 35 U.S.C. § 112, ¶ 1, as based on a non-enabling disclosure. Claims 3, 7 through 11, and 17 through 18 stand rejected under 35 U.S.C. § 112, ¶ 2, as indefinite due to failure to point out and distinctly claim the invention.

The claims were also rejected under 35 U.S.C. § 103. Claims 1, 5, 12, 13, and 15 stand rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu. Claims 2, 7, 8, 11, 14, and 18 stand rejected under § 103 as

unpatentable over Corwin et al. in view of Fukumizu and further in view of Crimmins et al. Claims 3 and 17 stand rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and further in view of Prakash. Claims 4 and 16 stand rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and further in view of Huynh.

Claim 6 stands rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and further in view of Eckstein, Jr. Claim 9 stands rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and Crimmins et al. and further in view of Hunt et al. Claim 10 stands rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and Crimmins et al. and further in view of Huynh et al. Claim 19 stands rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and further in view of Nakatani. Finally, claim 20 stands rejected under § 103 as unpatentable over Corwin et al. in view of Fukumizu and further in view of Hunt et al.

An amendment was filed after the March 21, 1994, Office Action (final). This amendment was not entered.

Rather than reiterate the arguments of Appellants and the Examiner, reference is made to the brief and answer for the respective details thereof.

OPINION

We will not sustain the rejection of any of the claims. Specifically, we reverse the rejection of claims 1 through 13 and

claims 15 through 20 under 35 U.S.C. § 112, ¶ 1; we reverse the

rejection of claims 3, 7 through 11, and 17 through 18 under 35 U.S.C. § 112, ¶ 2; and we reverse the rejection of claims 1 through 13 and claims 15 through 20 under 35 U.S.C. § 103.

1. The rejections under § 112, ¶ 1

In order to be enabling under 35 U.S.C. § 112, a patent application must sufficiently disclose an invention to enable those skilled in the art to make and use it. ***In re Buchner***, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991). "Although not explicitly stated in section 112, to be

enabling, the specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation.'" ***In re Wright***, 999 F.2d 1557, 1561, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993) *citing* ***In re Vaeck***, 947 F.2d 488, 495, 20 USPQ2d 1438, 1444 (Fed. Cir. 1991); ***In re Wands***, 858 F.2d 731, 736-37, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988); ***In re Fisher***, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970). "When rejecting a claim under the enablement requirement of section 112, the PTO bears an initial burden of setting forth a

reasonable explanation as to why it believes that the scope of protection provided by that claim is not adequately enabled by the description of the invention provided in the specification of the application; this includes, of course, providing sufficient reasons for doubting any assertions in the specification as to the scope of enablement." ***In re Wright***, 999 F.2d at 1561-62, 27 USPQ2d at 1513.

The Examiner provided a number of reasons for rejecting claims 1 through 13 and claims 15 through 20 as non-enabling. The first reason was that the drawings are missing several elements that are referred to in the specification. Page 8 of the specification refers to a background "37" of the image, but item 37 is not shown in Figure 2. The specification defines the background of the image as the portion which does not contain objects. The Examiner has failed to provide any explanation as to why a person of ordinary skill in the art would be unable to make and use the claimed invention due to the Appellants' failure to label background 37 in Figure 2. The rejection is therefore reversed.

Similarly, the specification refers to edge trace operations (57, 73, 81, 99, 113, and 137) as steps in certain of the

analysis chains that are described. It also refers to "second shadow subtract operation 127" as a step in one of the analysis chains that is described. These items are not labeled in the block diagram of the image analysis subroutine shown in Figure 3. The Examiner has failed to provide any

explanation, however, as to why a person of ordinary skill in the art would be unable to make and use the claimed invention due to the Appellants' failure to label these items in Figure 3. To the contrary, given that the specification describes the steps for each analysis chain in sequential order, a person of ordinary skill in the art would understand where the missing items should be located in Figure 3. The rejection is therefore reversed.

The Examiner argues that the specification does not clearly show how the output of step 90 is combined with the output of step 92 and how the output of step 124 is combined with the output of step 126. The Examiner has failed to provide an adequate explanation as to why it would require undue experimentation for a person of ordinary skill in the art to determine how to combine the outputs of these steps in order to make and use the claimed invention. The rejection is therefore reversed.

The Examiner argues that the specification should not use the reference number "35" after the word "pixel" each time that the word is encountered. In the Examiner's view, using

the reference number in this way is unnecessary and could cause confusion because different entities such as "three by three pattern of pixels" and "center pixel" are followed by the same reference number "35". While it might be clearer if the reference number "35" were not used in this way, the Examiner has not shown that a person of ordinary skill in the art would be unable to make and use the claimed invention due to this repeated use of the reference number "35". The rejection is therefore reversed.

Finally, the Examiner argues that the constant "C", which is contained in a formula given on page 16 of the specification, cannot be inferred from the context of the discussion. According to the specification, the constant C is used to scale the product of E_n f_n e^{xn} to within the range zero through ten. To determine the value for this constant, a person of ordinary skill in the art would simply need to know the minimum and maximum possible values for the product of E_n f_n e^{xn}. The Examiner has failed to

provide an adequate explanation as to why it would require undue
experimentation for a person of ordinary skill in the art to determine these values. Further, the Examiner has failed to explain why a person of ordinary skill in the art would be unable to make and use the claimed invention without knowing the constant C. The rejection is therefore reversed.

2. The rejections under 35 U.S.C. § 112, ¶ 2

Analysis of 35 U.S.C. § 112, second paragraph, should begin with the determination of whether the claims set out and circumscribe the particular area with a reasonable degree of precision and particularity; it is here where definiteness of the language must be analyzed, not in a vacuum, but always in light of teachings of the disclosure as it would be interpreted by one possessing ordinary skill in the art. ***In re Johnson***, 558 F.2d 1008, 1015, 194 USPQ 187, 193 (CCPA 1977), *citing* ***In re Moore***, 439 F. 2d 1232, 1235, 169 USPQ 236, 238 (1971). "The test for definiteness is whether one skilled in the art would understand the bounds of the claim when read

in light of the specification." **Miles Labs. Inc. v. Shandon Inc.**, 997 F.2d 870, 875, 27 USPQ2d 1123, 1126 (Fed. Cir. 1993) (citing **Orthokinetics, Inc. v. Safety Travel Chairs, Inc.**, 806 F.2d 1565, 1576 (Fed. Cir. 1986)).

The Examiner rejected claim 3 as indefinite because it provides that the fractal dimension is the "ratio of the perimeter of the object relative to the surface area of the object" but does not recite actually determining the ratio of the perimeter relative to the surface area. Claim 3 is reproduced as follows, with emphasis added to the relevant language:

3. The target recognition apparatus of claim 1, wherein:

a fractal dimension of objects within the digitized image is obtained in one or more of said chains, <u>the fractal dimension being a ratio of the perimeter of the object relative to the surface area of the object</u>.

The Examiner has not explained why a person of ordinary skill in the art would be unable to understand the bounds of

claim 3. A person of ordinary skill in the art would understand that claim 3 requires the determination of the ratio even though the determination of the ratio is not separately recited. The rejection is therefore reversed.

The Examiner rejected claims 7 through 11 on the grounds that the phrases such as "relatively dark", "relatively light",

and "lighter" are vague and indefinite as used in the claims. In the Examiner’s view, it is not clear what the criteria are

for determining the relativity. Representative claim 7 is reproduced as follows, with emphasis added to the relevant language:

> 7. A method for using a computer to recognize objects within a digitized video image, the method comprising:
>
> processing the digitized video image in a plurality of parallel processing chains, wherein;
>
> one or more of the processing chains for analyzing the content of the video image includes a series of processing steps for identifying a relatively light target against a relatively dark background, and;
>
> one or more of the processing chains includes a numerical inversion operation for inverting the shading within the image such that a relatively dark image on a relatively light background becomes equivalent to a relatively light image on a relatively dark background.

This rejection is reversed because a person of ordinary skill in the art would understand the bounds of the claim. They would understand, for example, that because it recites a "relatively light target against a relatively dark background", claim 7 requires that the target must be lighter than the background. The lightness of the target and darkness of the background are viewed in relation to each other.

The Examiner rejected claim 17 on the grounds that the claim language that recites the "ratio of the perimeter of each of the objects to the area of each such object" is vague and indefinite. According to the Examiner, it is not clear which of the objects are indicated. Claim 17 is reproduced as follows, with emphasis added to the relevant language:

> 17. The computerized mine detection apparatus of claim 12, wherein:
>
> one or more of the processing series determines a fractal dimension of the objects, the fractal dimension being the <u>ratio of the perimeter of each of the objects to the area of each such object</u>.

Again, this rejection is reversed because a person of ordinary skill in the art would understand the bounds of the claim. They would understand that the objects referred to in claim 17 are the objects that are being sensed in claim 12. They would also understand that, in claim 17, the fractal dimension of the object is determined by dividing the perimeter of each object by the area of that object.

Finally, the Examiner rejected claim 18 under § 112, ¶ 2, on the grounds that the term "light intensity" lacks antecedent

basis and is meaningless in the context of the claim. In the Examiner's view, it is not clear what role "light intensity" plays in a digitized image. The Examiner states that it is also not clear how light intensity is inverted. Claim 18 is reproduced as follows, with emphasis added to the relevant language:

> 18. The computerized mine detection apparatus of claim 12, wherein:
>
> one or more of the processing series inverts a light intensity of each of portion of the object within the image prior to discriminating the objects.

This rejection is reversed because a person of ordinary skill in the art would understand the bounds of the claim. It is common to refer to a data element in a digital environment by the names of the real world information which the data element represents. Thus, a person of ordinary skill in the art would understand that the phrase "light intensity" refers to a numerical value associated with a portion of the image based on a determination as to the intensity of the light in that portion of the image. They would further understand that claim 18 calls for the inversion of this numerical value.

Claim 18 is not indefinite under § 112, ¶ 2, even though the phrase "light intensity" was not introduced earlier in the claim, because a person of ordinary skill in the art would still understand the bounds of the claim.

Although the Examiner did not point it out, claim 18 appears to contain a typographical error. It appears to contain an extra "of" after the word "each". If so, the phrase "of each of portion" should be changed to "of each portion". Even with this typographical error, a person of ordinary skill in the art would still understand the bounds of the claim.

3. The rejections under 35 U.S.C. § 103

We will not sustain the rejection of claims 1 through 13 and claims 15 through 20 under 35 U.S.C. § 103. It is the burden of the Examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications contained in such teachings or suggestions. ***In re Sernaker***, 702 F.2d 989, 995, 217 USPQ 1, 6

(Fed. Cir. 1983). The Examiner has failed to set forth such a ***prima facie*** case.

a. Claims 1 through 6

The rejection of independent claim 1, and dependent claims 2 through 6, is based upon the Fukumizu reference teaching a plurality of analysis chains that are each, in the language of claim 1 (with emphasis added), "a distinct means for analyzing the image such that the object may be identified by one or more of said parallel analysis chains." We reverse these rejections because Fukumizu does not teach this element of claims 1 through 6.

Fukumizu discloses a pattern recognition apparatus that uses a neural network system. Pattern data is input into the system via a pattern input means, such as a scanner. Feature data is then extracted from the pattern data and input into a plurality of neural networks NET_i, with "i" representing the number of neural networks. *See* col. 3, lines 41-49. Each of the neural networks corresponds to a certain identification

class, each class being a known pattern that the system is looking to identify. *See* col. 3, lines 33-35, 47-49. The "neural networks operate in parallel and as a whole configure a single neural network system." *See* col. 3, lines 49-51. Each of the neural networks NET_i judges whether the input feature vector belongs to the class C_i, *see* col. 3, lines 62-65, and outputs the probability that the feature vector belongs to that class.

See col. 4, lines 4-8. The judgment unit 14 then judges which of the classes is likely to be the correct class, based on the probability data output from the neural networks, and outputs a result. *See* col. 4, lines 11-21.

The rejection of claims 1 through 6 turns on how the term "distinct" in claim 1 is interpreted. During patent prosecution, claims must be given their broadest reasonable interpretation. *See* **In re Morris,** 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-29
(Fed. Cir. 1997). The first place to look when interpreting a patent claim is the words of the claim themselves. *See*

Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582, 39 ordinary meaning unless the specification or file history clearly state that a special definition is intended. *Id.*

The Appellants' specification does not define the term "distinct." In ordinary usage, the term "distinct" can mean "separate" or it can mean "not alike." *See Webster's New Universal Unabridged Dictionary* 534 (deluxe 2d. ed., Dorset & Baber 1983). Each of the neural networks (i.e., analysis chains) in Fukumizu are separate from the other neural networks. If

"distinct" could be interpreted as meaning "separate", then Fukumizu would disclose this limitation of claim 1. However, when the term "distinct" in claim 1 is read in light of the other language of the claim, and in light of the specification, it must be interpreted as requiring that each analysis chains is not like the other analysis chains.

Claim 1 recites, in relevant part and with emphasis added, that "the image is processed in a plurality of parallel analysis chains, each of said analysis chains being a distinct means for analyzing the image." The recitation of a "plurality" of analysis chains itself requires multiple, separate analysis chains. The requirement that the analysis chains be "distinct" would be redundant with the "plurality" requirement if "distinct" meant that the analysis chains need to be separate from one another. Because each of the words in a claim must be assumed to have some meaning, it would not be reasonable to interpret "distinct" as synonymous with "separate." Thus, the term "distinct" must require that the analysis chains are not alike.

The specification supports this interpretation of claim 1. The specification states on page 8 that the preferred embodiment includes the following analysis chains: a positive texture chain, a negative texture chain, a positive background subtract chain, a negative background subtract chain, a positive edge enhancement chain, and a negative edge

enhancement chain. The bulk of the specification (pages 8-12) describes how each of these different analysis chains operates. Because the specification clearly discloses analysis chains that are not alike, it supports interpreting the "distinct" limitation in claim 1 as requiring analysis chains that are not alike.

In view of the above, multiple copies of the same analysis chain are not distinct means for analysis within the meaning of claim 1. To be distinct means for analysis, different calculation processes must be done. If the same calculation is done in parallel, these parallel processes do not constitute distinct analysis chains.

The neural networks in Fukumizu all do the same calculation. Each neural network has been taught to recognize a different class and therefore each has different weight data which it uses in performing the calculation. *See* col. 7, line 65 to col. 8, line 22. Thus, the neural networks do not constitute "distinct" means for analyzing within the meaning of claim 1.

b. Claims 7 through 11

The rejection of claim 7 is based upon the teachings of the Corwin et al. and Fukumizu, as applied to claim 1, taken in view of Crimmins et al. We reverse the rejection of claim 7, and of dependent claims 8 through 13, because the Examiner has not shown that there is a motivation to combine Crimmins et al. with Corwin et al. and Fukumizu. *See* **In re Rouffet**, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998) (holding that, when a rejection is based on a combination of prior art references, there must be some teaching, motivation, or suggestion to combine the references).

Claim 7 recites that the digitized video image is processed "in a plurality of parallel processing chains" and that "one or more of the processing chains includes a numerical inversion operation for inverting the shading within the image such that a relatively dark image on a relatively light background becomes equivalent to a relatively light image on a relatively dark background." The Examiner stated that Crimmins et al. discloses the concept of numerical inversion that is recited in claim 7. In the Examiner's view,

the motivation for combining the numerical inversion of Crimmins et al. with Corwin's automatic target recognition scheme and Fukumizu's neural network system is offered in Crimmins et al., which states that "the extension of machine vision to industrial or military operations requiring the detection of a more general classes of shapes and/or patterns has met with limited results." *See* Crimmins et al., col. 1, lines 24-26.

Crimmins et al. discloses a method and apparatus for automatic shape recognition in an image that is represented by a matrix of digital data signals. The method disclosed in Crimmins et al. includes the steps of:

> "(a) computing the complement of the first image matrix;
>
> (b) creating a first structuring element, representative of the shape to be recognized, as a matrix of digital data signals slightly larger in dimension than the shape;
>
> (c) creating a second structuring element equal to the window complement of the first structuring element;
>
> (d) eroding the first image matrix with the first structuring element to form a first transformation matrix;

> (e) eroding the complement image matrix with the second structuring element to form a second transformation matrix; and
>
> (g) combining the corresponding points of the first and second transformation matrices to form a result matrix wherein each non-zero point identifies an origin point where the shape has been recognized in the first image matrix."

See col. 2, lines 15-31 (indentation added). Nothing about this method suggests that it would be advantageous to use any of these steps in a neural network system. Neural networks operate in an entirely different manner than the Crimmins et al. method. The statement in Crimmins et al. which explains that prior art machine vision systems had met with limited results does not provide the motivation for doing image inversion in a neural network system. Because the Examiner has not provided a sufficient motivation to combine these references, we reverse the rejection of claims 7 through 11.

c. Claims 12 through 20

The rejection of claims 12, and dependent claims 13 through 20, is based upon the Fukumizu reference teaching a

plurality of processing series that can, in the language of claim 12, "independently processing the video image such that each of said processing series can independently determine if a mine is present in the image." We reverse the rejection of these claims because the neural networks in Fukumizu are not capable of independently processing an image to determine if a mine is present in the image. In Fukumizu, each of the neural networks
determines whether the input vector belongs to a certain identification class, each class being a known pattern that the system is looking to identify. *See* col. 3, lines 33-35, 47-49,
62-65. The neural networks do not operate independently to identify the object, but rather the "neural networks operate in parallel and as a whole configure a single neural network system." *See* col. 3, lines 49-51.

We have not sustained the rejection of claims 1 through 13 and claims 15 through 20 under 35 U.S.C. § 112, ¶ 1; of claims 3, 7 through 11, and 17 through 18 under 35 U.S.C. § 112, ¶ 2; or of claims 1 through 13 and claims 15 through 20 under 35 U.S.C. § 103 claims. Accordingly, the Examiner's decision is reversed.

REVERSED

KENNETH W. HAIRSTON Administrative Patent Judge	)	
LEE BARRETT Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
MICHAEL R. FLEMING Administrative Patent Judge	)	

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